[redacted] 25X1

Copy 10 of 10

29 August 63

MEMORANDUM FOR THE RECORD

SUBJECT : ONCART Engine Compressor Honeycomb Problem

1. Inspection of aircraft #121 and 122 on 27 August revealed excessive 2nd stage compressor rub conditions on both engines. Compressor rub, which in moderation is not abnormal, usually results from rapid aircraft decelerations with attendant rapid inlet temperature decreases. A rapid temperature decrease causes the lighter engine outer case to thermally contract faster than the heavier compressor rotor resulting in the rotor blade tips rubbing against the surrounding outer case honeycomb shroud. The honeycomb shroud is specifically designed to withstand moderate but not excessive rub. Both aircraft 121 and 122 have been flying speed extension, aircraft roughness, and heat soak programs wherein shock disgorgement and engine blow-outs and stalls with attendant rapid decelerations and temperature gradients have occurred at high Mach numbers.

2. The combined factors affecting the degree of compressor rub imposed by the above transients and the capability to absorb the rub are the built in clearance between the compressor blade tip and the honeycomb ("tip clearance") and the type of honeycomb (coarse or fine grain structure). The more tip clearance the less susceptibility to rub. The coarser the honeycomb structure, the less heat generated when rub does occur and the greater the capability to absorb the rub without damage. The combination of tip clearance and grain structure therefore is the determining factor.

3. As part of the performance improvement (Table III) package incorporated on engines 219 and up a change was made from a .050 inch tip clearance coarse honeycomb to a .030 inch min. tip clearance fine honeycomb. Both of these configurations passed full scale Mach 3 58 hour endurance tests. All engines prior to no. 219 now [redacted] have 25X1

25X1

[redacted]

[redacted] 25X1

.050 inch tip clearance coarse honeycomb and have not experienced excessive rub. All engines except one subsequent to no. 219 now [redacted] have .050 inch tip clearance fine honeycomb. (The only two engines which had the .030 inch tip clearance were reconfigured after a similar rub incident earlier in August.) It is evident from this latest incident involving the four engines in aircraft #121 and 122 that the .050 inch tip clearance fine honeycomb is not a good combination. 25X1

4. The following situation presently exists.

A. Eleven engines prior to no. 219 which have the acceptable combination of .050 inch tip clearance coarse honeycomb are [redacted] These engines cover all J58 aircraft except 121 and 122. 25X1

B. Seven engines subsequent to no. 219 which have the unacceptable combination of .050 inch tip clearance fine honeycomb are [redacted] and need modification. These engines were covering aircraft #121 and 122. 25X1 25X1

C. One engine subsequent to no. 219 has been modified to an acceptable interim combination of .080 inch tip clearance fine honeycomb and is [redacted] being prepared for test. 25X1

5. The following actions are underway.

A. Three engines having an acceptable interim combination of .080 inch tip clearance fine honeycomb are being airlifted [redacted] from Hartford today. They should arrive tomorrow. Approximately two work days will be required to install airframe plumbing and instrumentation and processing through the test stand prior to delivery to the aircraft for installation. These three plus the one engine cited in paragraph 4C are targeted for installation in aircraft #121 and 122. 25X1

SECRET

[redacted] 25X1

B. The first two of seven engine sets of acceptable .080 inch tip clearance coarse honeycomb are underway [redacted] now and should arrive tomorrow. These seven hardware sets targeted for the seven unacceptable engines will be assembled to the engines [redacted] with an estimated completion through test schedule of one per day starting Thursday, 5 September. Normally, any compressor rework such as involved here is done at overhaul because of the delicate rotor balancing operation required. In this instance, balance will be checked after assembly on the test stand prior to aircraft installation. It would not be illogical to expect that one or more of these engines may be out of balance during test and require return to overhaul for rebalance. The logic in taking this gamble is supported by two successful instances of similar compressor rework without rebalance in Florida. Florida factory personnel proficient in this rework are en route [redacted]

25X1 25X1 25X1 25X1

C. Appropriate engineering changes to establish acceptable honeycomb tip clearance/grain structure combinations are being incorporated in all Hartford production and overhaul engines prior to next delivery.

SIGNED

[redacted] 25X1

Aircraft Systems Division
(Special Activities)

25X1 [redacted] ASD/OSA [redacted] (29 Aug 63)

Distribution:
Cys 1&2 ADD/S&T (Giller)
3&4 AD/OSA
5 D/TECH/OSA
6&7 ASD/OSA
8 PS/OSA
9 ASD/OSA (chrono)
10 RB/OSA

SECRET